

REMARKS

Claims 1-17 are pending in the subject application. Claims 1, 7, 10, 11 and 15 have been amended. Support for the amendments is found throughout the specification as filed and no new matter is added by these amendments.

Favorable reconsideration in light of the remarks which follow is respectfully requested.

1. Claim Objections

Claim 15 has been objected to because the term "files" in line 2 appears to be a typographical error. Applicants have amended the term "files" to "films" to correct this typographical error. Reconsideration and withdrawal of the objection is respectfully requested.

2. 35 U.S.C. §102 Rejections

Claims 1, 3-6 and 11-14

Claims 1, 3-6 and 11-14 have been rejected under 35 U.S.C. §102(b) as being anticipated by Matsunaga et al (US 5,830,807). The Office asserts:

Matsunaga discloses a successive dry etching method of alternating laminate layers. This method using a mixed process gas supplied into a process chamber 1 to generate plasma to etch/process a wafer/substrate (col 4, lines 1-15). Matsunaga discloses that the substrate having an alternate laminate of silicon oxide and silicon film to be etched and the gas mixture ratio is changed in accordance with the material of a film to be etched (col. 4, lines 25-41; col. 5, lines 5-10), which reads on the substrate includes stacked films of at least two types to be etched, and according to any of the films that to be etched, a change is made in the process gas in the plasma generation period.

Regarding claims 3-5, 11-13, Matsunaga discloses changing the pressure of the process gas (a plasma generating condition for stably maintaining generation of the plasma) together/simultaneously with the change made in the process gas/changing the gas mixture ratio in the plasma generation period/etching period (col 7, lines 50-55)

Regarding claims 6, 14, Matsunaga discloses changing the power when the amount of gas is changed to give more directivity to the plasma etching (col 56-60)

Applicants respectfully traverse.

Applicants claim, in claim 1, a plasma processing method using a process gas supplied into a process chamber to generate plasma from the process gas and process a substrate placed in said process chamber by means of the plasma, wherein the substrate includes stacked films of at least two types to be etched by the plasma, and, according to any of said films that is to be etched, a change is made in the process gas in a plasma generation period without extinction/regeneration of the plasma.

Matsunaga describes a laminated structure formed by alternately laminating a silicon film and a silicon oxide film successively etched in the same chamber. According to Matsunaga, one film is etched by a combination of gases having a first mixture ratio and the second film is etched by a combination of gases having a second mixture ratio. (See e.g. Abstract) For example, a mixed gas of CF₄ and CHF₃ may be used to etch silicon oxide, with CF₄ being subsequently used to etch polycrystalline silicon. Alternatively, for example, a mixed gas of CF₄ and CHF₃, having a first CF₄ /CHF₃ ratio, may be used to etch silicon oxide, while a mixed gas CF₄ and CHF₃, having a second CF₄ /CHF₃ ratio, may be used to etch polycrystalline silicon. (See col. 5, lines 33-45)

As provided in MPEP-2131, a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Examination of the Matsunaga reference shows that there is no express description that the change made in the process gas is made in a plasma generation period without extinction/regeneration of the plasma. Rather, Matsunaga is completely silent with respect to the plasma. Thus, there is no express description.

Further, Applicants submit that providing for a change in the process gas is made in a plasma generation period without extinction/regeneration of the plasma is not inherently described by Matsunaga.

It is well-established that the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish inherency. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993); *In re Oelrich*, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981); MPEP §2112. "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities.'" *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999); MPEP §2112. Applicants note that "To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991); MPEP §2131.01.

As set forth above, the Matsunaga reference is completely silent with respect to the plasma when the change is made in the process gas. Further, there has been no extrinsic evidence provided that the process of Matsunaga would necessarily and clearly require that the change made in the process gas is made in a plasma generation period without extinction/regeneration of the plasma.

On the contrary, the opposite would be expected. In particular, in accordance with conventional methods wherein a stacked film is etched in a single process chamber, the process of etching is divided into two stages: a first etching and a second etching. In the first etching stage, a gas for the first etching is supplied, the pressure adjusted and the first etching carried out. The microwave power is then temporarily stopped. The gas for the second etching is then supplied, the pressure adjusted and the second etching carried out. Thus, in accordance with conventional methods, the plasma is extinguished after a first etching process and a plasma is regenerated in a second etching process.

Accordingly, the extrinsic evidence actually teaches the opposite of what Applicants' claim. Thus, the extrinsic evidence would not make clear that the missing descriptive matter (changing the process gas in a plasma generation period without extinction/regeneration of the plasma) is necessarily present in Matsunaga or that it would be so recognized by persons of ordinary skill. Rather, one would expect that, in accordance with conventional practices used by those of skill in the art, the plasma would be extinguished/regenerated.

Accordingly, each and every element of Applicants' claim 1 is not described, either expressly or inherently, in Matsunaga. Thus, claim 1 is not anticipated by Matsunaga. Claims 2-6 depend from claim 1 and, likewise, are not anticipated by Matsunaga. Claim 11 contains the terminology set forth above with respect to claim 1 and, thus, is also not anticipated by Matsunaga. Claims 12-14 depend from claim 11 and, likewise, are not anticipated by Matsunaga. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 7-9

Claims 7-9 have been rejected under 35 U.S.C. §102(b) as being anticipated by Watanabe et al (US 6,156,663). The Office asserts that

Watanabe discloses a plasma processing method using a process gas supplied into a process chamber (see abstract). This method comprises placing a substrate 100 includes a stacked films of one TiN layer/Ti-based film 102 and one TiN layer 104 (claimed one film other than a Al-based film (col. 6, lines 50-55), the films are serially etched (col. 7, lines 6-8), changing the gas composition, pressure and power resulting in the etching of the layers 102 and 104 (col 7, lines 9-16; fig. 5(b) and fib 5(c)), which reads on a change is made in the process gas in a plasma generation period according to any of the films that to be etched.

Applicants respectfully disagree.

Watanabe describes a method and apparatus for plasma processing. According to Watanabe, the sample is etched by using a mixed gas of BCl₃, Cl₂, CH₄ and Ar. (See e.g. col. 3, lines 36-40). Applicants respectfully disagree with the Office's assertion that Watanabe teaches:

changing the gas composition, pressure and power resulting in the etching of the layers 102 and 104 (col 7, lines 9-16; fig. 5(b) and fig 5(c)), which reads on a change is made in the process gas in a plasma generation period according to any of the films that to be etched.

Rather, according to col. 7, lines 9-16, when the etching conditions are gas flow rates of BCl_3 :20 sccm, Cl_2 :80 sccm, CH_4 :4 sccm and a total gas pressure of 2 PA, a microwave output of 800 W, RF power of 60W and a substrate temperature of 40°C, the result is shown in Fig. 5(b) is obtained. On the other hand, when the gas flow rates are BCl_3 :20 sccm, Cl_2 :80 sccm, CH_4 :4 sccm and Ar :96 sccm, and a total gas pressure of 3 PA, the result shown in Fig. 5(c) can be obtained. Thus, this portion of Watanabe merely appears to describe that varying gas mixtures and pressures can be used to obtain different results. It does not describe a process wherein, during a process on a single substrate (not a process on one substrate to determine the result and then another process on another substrate to determine the result), during the plasma generation period a change is made in the process gas.

Further, even if this portion of Watanabe could be interpreted to describe a process wherein during a process on a single substrate, during the plasma generation period a change is made in the process gas, Watanabe does not describe explicitly or inherently a process wherein when the change is made in the process gas in a plasma generation period without extinction/regeneration of the plasma. Rather, like Matsunaga, Watanabe is silent with respect to this.

For the above-reasons and for the reasons set forth regarding the Matsunaga reference, claim 7 is not anticipated by Watanabe. Claims 8-9 depend from claim 7 and, likewise, are not anticipated by Watanabe. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 15-16

Claims 15-16 have been rejected under 35 U.S.C. §102(b) as being anticipated by Watanabe et al (US 6,156,663) The Office asserts, in part, that:

* * * Watanabe is also silent about stopping the generation of plasma after the etching using the first gas composition/first etching (col. 7, lines 5-7), which reads on completing the first etching without

extinguishing the plasma, etching the stacked films by supplying a second gas composition into the process chamber, the second gas composition is different from the first gas composition (col. 7, lines 12-15). Watanabe is silent about stopping the generation of plasma between the two etching steps, which reads on the plasma is maintained without being extinguished until the second etching is started.

Applicants respectfully disagree.

As set forth above, it is questionable whether Watanabe actually describes a process wherein the process gas is changed during etching of a single substrate rather than merely describing varying results that can be obtained on a substrate using different process gases.

Nonetheless, even if Watanabe does describe such a process, as acknowledged by the Office, Watanabe is silent about whether the generation of plasma is stopped after the etching using the first gas composition/first etching. However, the Office goes a step further and asserts that the fact that Watanabe does not say anything about the plasma means that it is not stopped. Applicants strongly disagree with this assumption. In particular, the silence of a reference regarding a claim element does not necessarily mean that that process element does not occur. Further, this reasoning is not consistent with the MPEP.

To anticipate a claim, each and every element as set forth in the claim must be found, either expressly or inherently described, in a single prior art reference. *Verdegel Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Applicants clearly claim a process wherein a change is made in the process gas in a plasma generation period without extinction/regeneration of the plasma. As acknowledged, Watanabe is silent about the plasma during a change in process gas. Thus, as acknowledges, Watanabe does not expressly describe this. Further, Applicants submit that this element would not be inherent as set forth in detail above regarding Matsunaga. In particular, inherency can only be established if the extrinsic evidence makes clear that the missing descriptive matter is necessarily present, and that it would be so recognized by persons of ordinary skill. *In re Robertson*, 169 F.3d

743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999); MPEP §2112. In particular, "To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991); MPEP §2131.01.

As set forth above, extrinsic evidence (the conventional methods used by those of skill in the art) would teach the opposite (that the plasma is extinguished/regenerated). Thus, rather than make clear that the missing descriptive matter is necessarily present, the extrinsic evidence makes it probable that the missing descriptive matter is not present.

Accordingly, each and every element of claim 15 is not described, either explicitly or inherently, by Watanabe. Thus, claim 15 is not anticipated by Watanabe. Claim 16 depends from claim 15 and, likewise, is not anticipated by Watanabe. Reconsideration and withdrawal of the rejection is respectfully requested.

3. 35 U.S.C. §103 Rejections

Claims 2 and 10

Claims 2 and 10 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Matsunaga et al (US 5,830,807) in view of Chung (US 5,658,820). The Office asserts that while Matsunaga does not disclose changing bias voltage applied to the substrate together with the change made in the process gas/changing the gas mixture ratio in the plasma generation period/etching period, that Chung teaches this and, thus, it would have been obvious to modify Matsunaga in view of Chung.

Applicants respectfully disagree for the reasons set forth above regarding Matsunaga. In particular, Matsunaga does not describe or suggest, either explicitly or inherently, a process wherein a change is made in the process gas in a plasma generation period without extinction/regeneration of the plasma.

Further, Applicants reassert that Chung does not describe a process wherein a change is made in the process gas or bias voltage. Rather, Chung describes a process for the manufacture of a ferroelectric thin-film wherein the film is etched by using Ar, chloric and fluoric gases of a predetermined composition ratio and an RF power of a predetermined frequency and power (see Abstract; col. 1, line 61 – col. 2, line 2). The Figures cited by the Office (Figs. 8-10) merely show graphs of etch rate vs. gas ratio (Fig. 8), etch rate vs. power applied to RF coil (Fig. 9) and etch rate vs. bias voltage (Fig. 10). The related text merely describes an experimental process wherein optimal gas ratios, power applied to RF coil and bias voltage can be determined by testing varying gas ratios, power applied to RF coil and bias voltage and plotting the results in graphical form (see col. 4, lines 11-64). Given the results shown in the graphs, one then uses the optimal results as the "predetermined" values to carry out the etching.

Nonetheless, a combination of Matsunaga and Chung still does not teach or suggest a method wherein a change is made in the process gas in a plasma generation period without extinction/regeneration of the plasma. As with Matsunaga, Chung does not teach or suggest this claim element nor would it be inherent as set forth in more detail above regarding the Matsunaga reference.

Accordingly, claims 1 and 10 are patentable over Matsunaga in view of Chung. Claim 2 depends from claim 1 and, likewise, is patentable over Matsunaga in view of Chung. Reconsideration and withdrawal of the rejection is respectfully requested.

Claim 17

Claim 17 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al (US 6,156,663) in view of Whetten (US 1,153,754).

As set forth above, Watanabe does not teach or suggest a method wherein, a first etching with plasma is performed using a first process gas, completing the first etching without extinguishing said plasma, a second etching is performed by supplying a second process gas different from the first process gas where the plasma is maintained without being extinguished until the second etching is started.

Further, Whetten is merely cited as describing a method for forming an LCD by processing/plasma etching the stacked layers on the substrate to form a LCD. Whetten does not teach or suggest a method wherein, a first etching with plasma is performed using a first process gas, completing the first etching without extinguishing said plasma, a second etching is performed by supplying a second process gas different from the first process gas where the plasma is maintained without being extinguished until the second etching is started.

Accordingly, claim 17 is patentable over Watanabe in view of Whetten. Reconsideration and withdrawal of the rejection is respectfully requested.

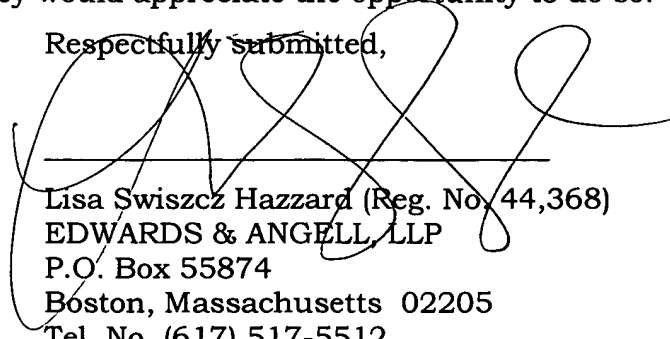
CONCLUSION

Reconsideration and allowance of claims 1-17 is respectfully requested in view of the foregoing discussion. This case is believed to be in condition for immediate allowance. Applicant respectfully requests early consideration and allowance of the subject application.

Applicants, conditionally petition for an extension of time to provide for the possibility that such a petition has been inadvertently overlooked and is required. As provided below charge Deposit Account No. **04-1105** for any required fee.

Should the Examiner wish to discuss any of the amendments and/or remarks made herein, the undersigned attorney would appreciate the opportunity to do so.

Respectfully submitted,



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